

DOCUMENT RESUME

ED 383 145

EC 303 969

AUTHOR Heimann, Mikael; And Others
TITLE On the Effect of Multimedia Computer Programs: Gains Made by Children with Autism in Reading, Motivation, and Communication Skills.
INSTITUTION Gothenburg Univ. (Sweden). Dept. of Psychology.
SPONS AGENCY Swedish Council for Social Science Research, Stockholm.
PUB DATE Mar 95
CONTRACT 90/0090; 92-0173
NOTE 14p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (61st, Indianapolis, IN, March 30-April 2, 1995). Research also suggested by a grant from the First of May Flower Annual Campaign for Children's Health.
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)
EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Autism; Communication Skills; *Computer Assisted Instruction; Educational Media; Educational Technology; Elementary Secondary Education; Foreign Countries; Instructional Material Evaluation; *Interactive Video; Language Acquisition; *Language Impairments; Media Adaptation; *Multimedia Instruction
IDENTIFIERS Sweden

ABSTRACT

An interactive multimedia program to facilitate the acquisition of reading, writing, and overall communication skills in children with significant language delays was developed and evaluated in Sweden with two studies. Participating in the first study were 11 children (ages 6 to 13) with autism, 9 children (mean age 13) with mixed disabilities, and 10 normal pre-school children (mean age 6). The software used (Alpha Interactive Language Series/Gator Super Sentences) was constructed to facilitate language learning through multichannel feedback (voice, animation, and video). In the second study, 11 children (ages 4 to 11) with autism used a Swedish version of the software, DeltaMessages. This software allows for adjustment to individual learning needs and the combining of various language modes. Both studies unambiguously demonstrated that an interactive microcomputer learning environment facilitated language learning for children with autism. Verbal exchanges and positive feelings related to the learning situation were also observed. (DB)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

On the effect of multimedia computer programs: Gains made by children
with autism in reading, motivation, and communication skills

Mikael Heimann
Department of Psychology
Göteborg University, Sweden

Tomas Tjus
Department of Psychology
Göteborg University, Sweden

Keith E Nelson
Department of Psychology
Pennsylvania State University, USA

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it.
☐ Minor changes have been made to improve
reproduction quality.

* Points of view or opinions stated in this docu-
ment do not necessarily represent official
OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL
IN OTHER THAN PAPER COPY HAS BEEN,
GRANTED BY

Mikael Heimann

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Author note: Poster presented at the Biennial Meeting of the Society for Research in Child Development, Indianapolis, March 1995. This research was supported in by two grants from the Swedish Council of Social Research, Stockholm (#90/0090 and #92-0173) and one grant from the First of May Flower Annual Campaign for Children's Health, Göteborg to Mikael Heimann. We gratefully acknowledge the assistance of Mats Lundälv, Margareta Kärnevik, Eva Lundälv, Lisbeth B Lindahl, and Cathy Agostinelli in conducting this study. Special thanks are also due to all the participating children, their families, and their school teachers.

Address of correspondence: Mikael Heimann, Dept. of Psychology, Haraldsgatan 1, S-413 14
Göteborg, Sweden. Email: Mikael.Heimann@psy.gu.se

INTRODUCTION

One of our overall goals has been to develop and evaluate the impact of interactive multimedia procedures for facilitating the acquisition of reading, writing, and overall communication skills in handicapped children with significant language delays (Heimann et al., 1993, in press; Nelson et al., 1991). The procedures implemented capitalize on the effect of programs that allows a child to construct various sentences in text on the computer and receive feedback in the form of spoken language, graphic animations or short video clips. Two different software programs (Alpha and DeltaMessages, see below) were used but with the same basic procedures: 1) the child learns by creating test sentences that then trigger colorful multimedia graphics matching the sentences, and 2) the child demonstrates mastery by seeing new graphics and responding with a text sentence that accurately describes the graphic event, e.g.: "The ghost feeds the dinosaur". The two studies reported here focuses on the effect of these multimedia procedures on reading and communication skills among children with autism.

At the *motivational level*, we assumed from the outset that the child's initiation and control of exploratory multimedia sequences would promote high motivation for learning new language structures and also for an increase in verbal interaction with the teacher. At the *communicative and cognitive level*, advances in text skills were assumed to depend upon efficient comparisons between challenging text and supporting already-established representations for voice or sign and for nonlinguistic events. Finally, the "*side conversation*" between teacher and child was designed to facilitate the child's progress toward higher levels of structure in their first language.

METHOD

Study 1

Subjects

The subjects were nine boys and two girls with autism diagnosed according to the DSM-III - R (APA, 1987) as suffering from autistic disorders (CA: 6:9 - 13:8; MA: 3:0 - 9:5; Language age, LA: 2:9 - 7:0). In addition, two other groups were included as comparisons: nine children (4 boys) with mixed handicaps (mean CA: 13:1; MA: 5:0 - 6:6; LA: 2:8 - 7:0), and ten normal preschool children (mean CA: 6:4; mean MA: 6:3; LA: 6:3 - 7:0).

Procedure

The children received approximately 20 training sessions during three to four months ($M = 13.6$ weeks; $SD = 8.3$). Each session lasted about 30 min.

The *software* used in the study, Alpha Interactive Language Series/Gator Super Sentences (Nelson & Prinz, 1991), was constructed to facilitate language learning through multichannel feedback (voice, animation, video, and sign language). For this study, sign language was not incorporated and Alpha was translated to Swedish using the words and animations already incorporated in the US. version.

Several *measures* were used in order to assess each child's language and communication skills before and after the training period: Reading of words, sentences, letter identification, phonological awareness, and sentence imitation. In addition, a video analysis of each child's communicative behavior was also implemented (example of categories: complies, off task, seeks help, verbal expressions, and enjoyment; reliability, $k = .81$).

The Alpha program: The Swedish Alpha consists of 112 lessons, all aimed towards developing a basic reading and writing vocabulary, and the ability to create simple sentences using this vocabulary. The program makes it possible to select one out of four main working modes: Individual Words (IW), Creating Sentences (CS), Testing Words (TW), and Testing Sentences

(TS). Initially all children started with the Individual Word mode in order to learn the vocabulary of a particular lesson. When the child mastered the lesson, the child moved on to the Creating Sentences mode. Within this mode a child could create sentences by combining earlier learnt nouns with new verbs. That is, selection of a simple noun-verb-noun sequence like "The bear" - "jumps over" - "the horse" creates an animation showing the action the child has described..

Moreover, the child and his or her teacher also had the option of deciding what speed to choose for the on-screen-animations. After having explored a lesson in the Creating Sentences mode twice the teacher switched to the Testing Sentences (TS) mode for that lesson. In this mode, the program produced an animated depiction of a noun-verb-noun sequence randomly generated from the vocabulary used in the lesson. After having watched the animation, the child had to select the nouns and the verb to construct the sentence that described what the child had just seen. At any given level, a child was judged to have reached mastery if reaching a score of or above 80 percent correct in the TS mode.

Equipment: Apple IIe or Apple IIGS with a minimum of 128 K RAM, a printer, and a Sony videodisc-player (LDP-3600D).

Study 2

Subjects

The subjects were eleven children with autism (eight boys; diagnosed according to the DSM-III - R, APA, 1987). as suffering from autistic disorders (CA: 4:11 - 11:11; MA: 5:0 - 10:9).

Procedure

The children used a Swedish version of *DeltaMessages* and received treatment during three to four months ($M = 13.5$ weeks; $SD = 6.7$). The baseline and the follow-up periods were between one and two months long ($M = 6.5$, $SD = 1.7$ respectively $M = 6.7$, $SD = 2.1$). All children received training

more than once every week and each session with lasted between 15 and 30 minutes.

Our new *software*, (*DeltaMessages*; Nelson & Heimann, 1994) makes it possible to adjust to the needs of the individual learner and to employ particular combinations of language modes as in the following example: a child may construct a sentence in text and then see the appropriate meaning only a few seconds later in sign language and also see video clips and/or graphics of the relevant events. *DeltaMessages* is programmed in HyperCard 2.2. MacroMind 3.1 has been used for animations and QuickTime for inserting video clips.

Multiple *assessments* were carried out for all children (during baseline, at start, during the intervention,, at the end, and at a follow-up). In addition, the software itself builds in brief but effective assessment activities as a part of every session with the computer and teacher.

The DeltaMessages program: Depending on the needs of the individual learner, particular combinations of language modes can be employed, as in the following possibilities: (1) graphics and speech can be presented after the child writes a sentence such as "The horse with the black spots chased the red fox away from her colt"; (2) after the child sees a graphic illustration of a sentence the computer asks the child to choose from a set of alternatives the best spoken, written or signed sentence that communicates the graphic meaning; and (3) children who have motor handicaps uses specially adapted controls for the computer enabling them to complete all multimedia explorations and tests that other children experience. In cognitive processing terms, combinations of presentation modes are chosen so that each child finds it easy to process their best modes (e.g. graphics, speech) and to learn new levels of communication. The system is also used in a way that takes advantage of the skills of the teacher in providing rich

conversational models and in helping to motivate the child's learning from the multimedia material.

The program consists of a total of 10 lessons. Lesson 1-6 makes it possible to construct noun-verb-noun sequences. Lesson 7 and 8 adds prepositions, and lessons 9 and 10 makes use of conjunctions and adjectives. A total of 60 words are used in the current version of the program making it possible to construct 190 different sentences. *DELTAMessages* also includes two pretests and two posttests for each lesson.

Equipment: Macintosh LC, 8MB RAM, SyQuest 44MB and a StyleWriter.

RESULTS

Study 1

Reading: A reading score based on the combined results from two word tests and one sentence reading test was used in both study 1 and 2. In study 1, we found clear increases in observed reading scores during the intervention period (see Figure 1) for both children with autism ($t(8) = 2.85; p < .05$) and mixed handicaps ($t(7) = 1.79; p < .06$). In contrast, the normal pre-school children displayed strong gains both with and without the extra computer support provided in this study.

Insert Figure 1 About Here

Phonological awareness : Figure 1 also show a clear gain in phonological awareness for the children with autism as an effect of the instruction ($t(7) = 2.5; p < .03$).

Verbal behavior and motivation: Observations of the children's actual classroom behavior reveal strongly significant positive changes among the children with autism in "verbal expression", ($t(10) = 2.89; p < .01$), "enjoyment", ($t(10) = 2.19; p < .03$), and "seeks help" (see Figure 2). These findings implies that the autistic children were much more prone to talk with

their teacher and to express positive feelings towards the end of the intervention period than early on.

Insert Figure 2 About Here

Prediction of treatment effects: The children's estimated mental age ($r = .50$, $n = 16$; $p < .05$), receptive language age ($r = .45$, $n = 16$; $p < .05$), and initial sentence imitation scores ($r = .78$, $n = 14$; $p < .05$) were the best predictors of gains in word reading due to the intervention. No strong predictor for gains in phonological awareness was found.

Insert Figure 3 About Here

Types of sentences created: Figure 3 shows that the program motivates the children to create new and fanciful events. A significant increase is noted for the children with autism while, at the same time, the number of realistic sentences decreases over time, and a similar pattern is discerned for the children with mixed handicaps. In contrast, normal pre-school children display a somewhat different pattern: An increase of fanciful sentences but no change in amount of realistic sentences.

Study 2

Reading: A significant increase ($t(10) = 2.89$; $p < .02$) in word and sentence reading is noted between the baseline and the intervention periods as shown in figure 4.

Insert Figure 4 About Here

Phonological awareness: As in study 1, a significant increase in phonological awareness was also observed (fig. 4). A comparison between the baseline period and the intervention period yielded a strong effect ($t(10)$

= 2.66; $p < .03$) as did a comparison between the baseline and the follow-up period ($t(10) = 2.73$; $p < .03$)

DISCUSSION

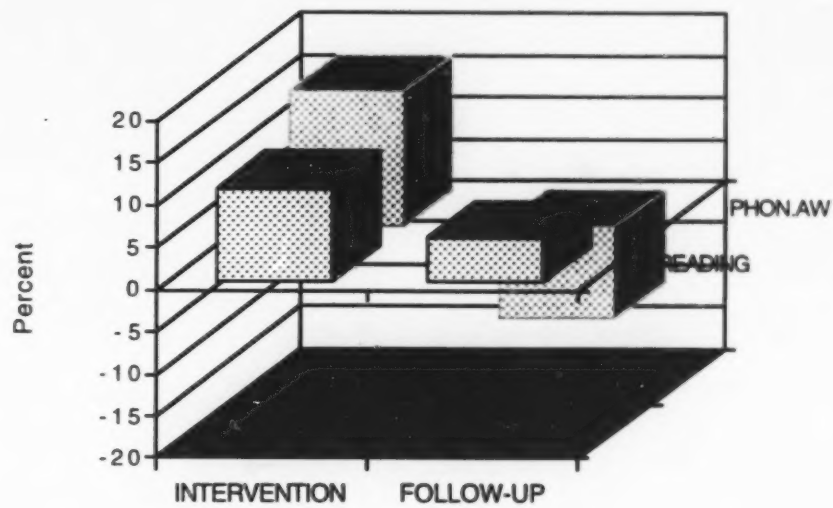
Both studies unambiguously demonstrate that an interactive microcomputer learning environment facilitates language learning for children with autism. We observed considerable progress both for the in-built tests and for tests measuring word reading, phonological awareness, and sentence imitation. Moreover, our intervention also stimulated verbal exchanges as well as positive feelings related to the learning situation. Overall, it is our view that these effects are potentiated if the CAI is employed in a setting where the teacher promotes a warm and supporting atmosphere and uses recasts, questions and elaboration's that ties in with the child's activity on the computer. Through such strategies the teacher promotes a learning environment that maximizes the likelihood for the child to learn the new language structures presented within the multimedia lessons.

A key feature with both our programs is that they allow a child to write any kind of sentence with the words included in the program. This freedom might be more of a change for a child with autism than for a normal pre-school child since programs aimed at children with autism tend to focus on a more structured environment for teaching language skills. However, a tentative interpretation of our results is that this imposed limitation in language use might make us miss any possible positive impact on language development provided by fun and challenging fantasy-sentences.

REFERENCES

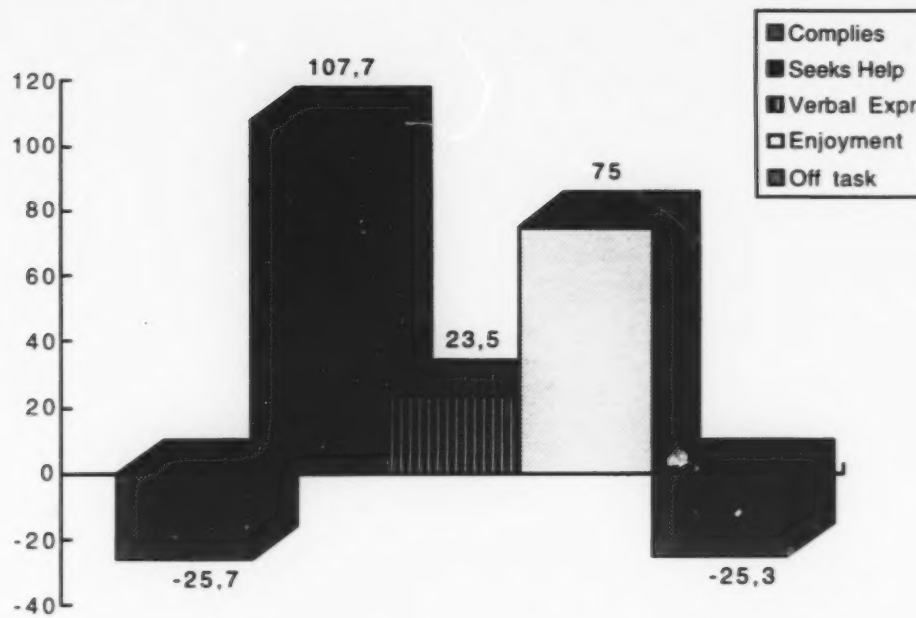
- Heimann, M., Nelson, K.E., Gillberg, C. & Kärnevik, M. (1993). Facilitating language skills through interactive microcomputer instruction: Observations on seven children with autism. Scandinavian Journal of Logopedics and Phoniatrics, 18, 3-8.
- Heimann, M., Nelson, K.E., Tjus, T. & Gillberg, C. (in press). Increasing Reading and Communication Skills in Children With Autism Through An Interactive Multimedia Computer Program. Journal of Autism and Developmental Disorders.
- Nelson, K.E. & Heimann, M. (1994). DELTAMessages - a multimedia software for language learning. Computer software program. Warriors Mark, PA: Super Impact Images, and Göteborg, Sweden: Topic DOS Hb.
- Nelson, K.E., & Prinz, P.M. (1991). Alpha Interactive Language Series/Gator Super Sentences. Computer software program. Warriors Mark, PA: Super Impact Images.
- Nelson, K.E., Prinz, P.M., Prinz, E.A., & Dalke, D. (1991). Processes for text and language acquisition in the context of microcomputer-videodisc instruction for deaf and multihandicapped deaf children. In D.S. Martin (ed.), Advances in Cognition, Education, and Deafness. (pp. 162-169). Washington, DC.: Gaullaudet University Press.

Figure 1



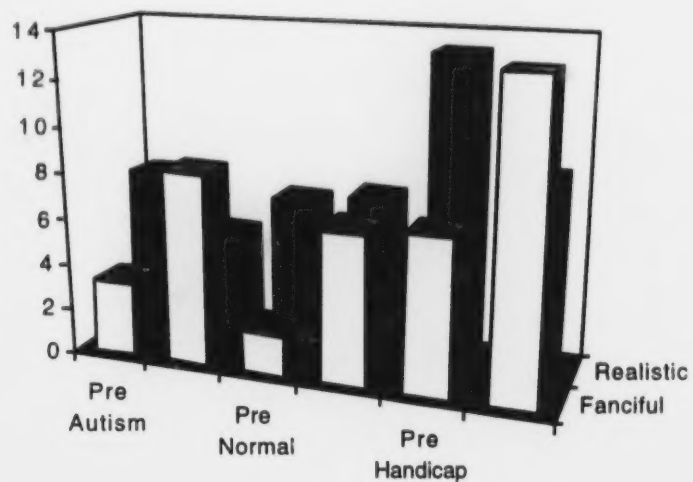
Study 1: Alpha: Average gain in reading (n=9) and phonological awareness (n=8)

Figure 2



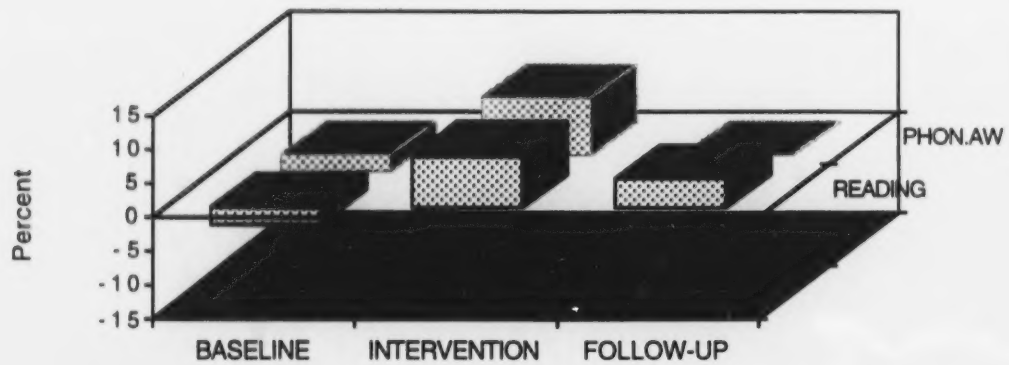
Study 1: Alpha: Percent change in communication scores during the intervention period

Figure 3



Study 1: Alpha: Mean frequencies of fanciful and realistic sentences created by the three groups of children in study 1 (autism, $n=9$; mixed handicaps, $n=9$; pre-school, $n=8$).

Figure 4



Study 2: *DeltaMessages*: Average gain in reading and phonological awareness